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L9: Entry 8 of 8 File: USPT Aug 24, 1982

DOCUMENT-IDENTIFIER: US 4345558 A
TITLE: Knock detecting apparatus for an internal combustion engine

Detailed Description Text (35):
As shown in FIG. 13, the filter circuit 308 comprises a pair of band-pass filters 681 and 682 respectively having bands of 7 to 10 kHz and 11 to 13 kHz, analog switches 683 and 684, and a NOT gate 685, whereby the filter constant for the output of the vibration detector 2 is changed to a low filter value (7 to 10 kHz) or a high filter value (11 to 13 kHz) in accordance with the output of the filter control circuit 310. As shown in FIG. 13, the filter control circuit 310 comprises voltage setting means 612 and a comparator circuit 611 for receiving the output voltage V.sub.s of the voltage setting means 612 and the output voltage V.sub.i of the integrator circuit 432 which is indicative of the engine speed, whereby depending on whether the engine speed is higher than a predetermined value, a control signal is generated to close one or the other of the analog switches 683 and 684.

Detailed Description Text (44):
The vibration noise level also varies in dependence on the engine load condition (the noise tends to increase with an increase in the load). Thus, the engine load condition (e.g., the intake vacuum of less than -150 mmHg) may be detected as an engine condition parameter by an intake pressure sensor (not shown) or by means of a throttle position signal to apply the resulting signal to the filter control circuit 310. In addition, the same operation can be performed by applying a plurality of parameters (engine speed, intake vacuum, etc.) as the filter selecting conditions.

Detailed Description Text (48):
Further, while, in the above embodiment, the band-pass filters are used, it is possible to use a high-pass filter and a low-pass filter as occasions demand.

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L9: Entry 2 of 8 File: PGPB Oct 17, 2002

DOCUMENT-IDENTIFIER: US 20020152007 A1
TITLE: Method and device for controlling a drive unit of a vehicle

Detail Description Paragraph (3):
[0012] The figure shows an internal combustion engine 100 connected to a controller 110. Controller 110 processes signals of various sensors 115 and a signal QKF supplied by a filter means 120. Filter means 120 receives signal QK as an input quantity. The filter means also processes the output signals of various sensors 125. Signal QK is supplied by a quantity input 130. The quantity input receives signals from a accelerator pedal position sensor 140 and various sensors 135.

Detail Description Paragraph (4):
[0013] Starting from the position of the accelerator pedal, the accelerator pedal position sensor 140 generates a signal FP with regard to the position of the accelerator pedal. The accelerator pedal position sensor may be designed as a rotary potentiometer, for example. A resistance value and/or the voltage drop on the potentiometer is used as the signal in this case.

Detail Description Paragraph (5):
[0014] Starting from the output signal of accelerator pedal position sensor 140 and the output signals of various sensors 135, quantity setpoint 130 calculates signal QK, which is a measure of the power desired from the engine. Fuel quantity QK is selected, for example, according to sensors 135, which detect various temperature values, pressure values and other operating states.

Detail Description Paragraph (13):
[0022] A PTD1 element may be used as low-pass filter 210. However, other filters having low-pass characteristics may also be used according to the present invention. Filters having a DT1 characteristic may be used as the first and second high-pass filters. However, other filters having high-pass performance characteristics may also be used.

Detail Description Paragraph (19):
[0028] Output limit 290 guarantees that the highest allowed quantity values are not exceeded. Through suitable choice of lag elements, input limiter, the transmission characteristic of the high-pass filters, the low-pass filter and output limiter, the performance of the filter may be optimally adapted to any desired vehicle.

Detail Description Paragraph (25):
[0034] The procedure according to the present invention is not limited to the embodiment described here having a low-pass filter and a high-pass filter. In particular, corresponding digital filters having a suitable performance characteristic may also be used. It is essential that filtering takes place so that the filtered signal has at least a corresponding pulse in the transition to a modified signal. This means that a positive pulse occurs in the transition to an increased value, and a negative pulse occurs in a transition to a lower value.

L9: Entry 6 of 8 File: USPT Jul 6, 1999

DOCUMENT-IDENTIFIER: US 5919244 A
TITLE: Desired performance input fuzzy logic control system for automatic transmissions

Brief Summary Text (14):
The problem on which the invention is based is solved by the fact that at least the input variables of the throttle valve position or accelerator pedal position and the adjustment dynamic thereof are interlinked by fuzzy generating rules according to magnitude and direction as a function of time. The quantity resulting from said linkage represents a desired performance of the driver. It forms an input variable for a set of basic and additional rules of fuzzy generating rules. By the designation desired performance is to be understood here a functionally composed quantity which gives information as to the extent to which the driver is satisfied with an actual driving mode. In a simpler embodiment it suffices in the first place to process the desired performance in combination with the parameters engine speed, throttle valve position, gradient and the actual speed level in fuzzy generating rules. These represent the expertise of a driver of a vehicle equipped with a transmission to be manually shifted. The disadvantages of the prior art in automatic transmissions are prevented by using fuzzy logic methods. Said disadvantages are to be attributed in the first place to the fact that the shift diagrams contain exact decisions thresholds and are conditioned only on the basis of throttle valve opening and vehicle speed.

Brief Summary Text (16):
The quantity of the desired performance used in the set of basic and additional rules is preferably generated as an output variable in an independent fuzzy module. It has proved very convenient here if the connection between accelerator pedal position (throttle valve position) and the gradients thereof is found from the survey of a representative cross section of drivers. The connection between said quantities and the desired performance derived therefrom is naturally liable to a subjective variation. The survey of a representative cross section of drivers creates a neutral base for judgment independent of whether a particular driver drives sportingly or economically.

Drawing Description Text (5):
FIG. 5 is a matrix representation of the control equipment for detecting the desired deceleration according to the position or change of position of an accelerator pedal;

Detailed Description Text (31):
Parameters used . . . throttle valve position, throttle valve gradient, engine speed

Detailed Description Text (35):
Parameters used . . . throttle valve position, throttle valve gradient, engine speed, actual speed level

Detailed Description Text (38):
The above formulated rules 1 to 6 form the basic set of rules of fuzzy generating rules for determining the shifting point. Instead of the parameters throttle valve position and gradient of the throttle valve position, equivalent parameters appear depending on the nature of the performance regulating mechanism of the engine. Insofar as the parameter engine speed is used in the basic set of rules, other parameters from the turbine speed (transmission with converter), from the transmission input speed or from an equivalent parameter can be used as substitutes. These are, for example, the

position of the accelerator pedal and the change of position of the accelerator pedal (E-gas or the like). In this set of basic rules the driver's desired performance is taken into account.

Detailed Description Text (44):
Parameters used . . . desired performance (throttle valve position, throttle valve gradient), engine speed, actual speed level

Detailed Description Text (48):
Parameters used . . . throttle valve position, throttle valve gradient, actual speed level

Detailed Description Text (103):
The input quantity "desired performance" used in the sets of basic and additional rules is generated in a fuzzy module (functional block 16) according to fuzzy generating rules. The desired performance can correspond here to a desired acceleration or deceleration. In order to represent the desired performance communicated by the driver via the accelerator pedal, said fuzzy module produces an output variable that contains both the absolute accelerator pedal position (throttle valve position) and the adjustment dynamic thereof. Accordingly, the desired performance is not interpreted as a quantity proportional to the absolute accelerator pedal position (throttle valve position). Rather, the dynamic indicated by the driver via the accelerator pedal (throttle valve position) is also taken into consideration.

Detailed Description Text (104):
The invention proposes a possibility of linking the absolute accelerator pedal position (throttle valve position) with the adjustment activity (dynamic), specifically by there being integrated within said fuzzy module 16 the absolute accelerator pedal positions and the gradients thereof. As output variable, said fuzzy module makes available an essentially more appropriate representation of the quantity "desired performance." In said output variables, the fact that the exclusive evaluation of the change in accelerator pedal position shows a non-linear dependence on the momentary range of the accelerator pedal position at a specific evaluation moment is taken into consideration.

Detailed Description Text (105):
Since the interrelation between the accelerator pedal position (throttle valve position) and gradients thereof (adjustment of the throttle valve position as a function of time), and the desired performance derived therefrom is naturally liable to a subjective personally conditioned variation, the control equipment belonging to the fuzzy module "desired performance" was determined in the form of a matrix from the survey of a representative cross section of drivers. Said survey yielded a neutral base of judgment independent of whether a precisely acting driver drive sportingly or economically. The interrelations are reproduced in FIG. 2.

Detailed Description Text (106):
In the lines of said matrix are plotted the possible accelerator pedal positions (throttle valve positions) of SG (very large), G (large), M (medium) and K (small) to SK (very small). The columns contain the amounts of change of accelerator pedal position (change of throttle valve position) extending likewise from SG (very large) to SK (very small).

Detailed Description Text (108):
In FIG. 3 and FIG. 4 is shown part of the fuzzy (sub) sets resulting from the reduction of the theoretical number of rules. In the upper diagram (FIG. 3) the sets are reproduced in the example of the change in accelerator pedal position. On the abscissa are plotted the levels of change in accelerator pedal position (percent/second). On the ordinate are plotted related values my from 0 to a maximum of 1. The flat amount of change in accelerator pedal position "positively very small" is plotted by the trapezoidal fuzzy set drawn on the left. The flat amount of change in accelerator pedal position "positively great" is defined by the likewise trapezoidal fuzzy set to the right. Between the flat amounts "positively very small" and "positively great" is the flat amount of change in accelerator pedal position "positively great".

Detailed Description Text (109):
Similarly to this, the diagram in FIG. 4 shows individual fuzzy (sub) sets in the example of the levels of the accelerator pedal position. The flat amounts (in percent) accelerator pedal position "very small", "not great", "small", "medium", "great", "not small" and "very great" are defined by triangular fuzzy sets.

Detailed Description Text (110):
The rules that control the output variable "desired performance are preferably provided with a gamma operator with the compensation degree of 0.3. Said step acts in medium and great values of the change in accelerator pedal position in the sense of an OR operation. The output variable is controlled by a great throttle valve position or great throttle valve gradients. In the conclusion part, the related functions of the output variables are described by simple delta functions with the value of 1 (one).

Detailed Description Text (116):
The deceleration discussed is realized by a functional filter structure (functional block 17). The deceleration time constant can be adapted according to the situation. This adaptation takes place preferably in a manner such that in case of high filter input signal values, small time constants (slow reaction) are added up while low filter input signal values produce high time constants (quick reaction). Account is thus taken of the circumstances that in the lower load range (small desired performance) the driver would like to act more responsively upon the vehicle than in the upper load range.

Detailed Description Text (118):
In FIG. 10 is diagrammatically reproduced a possible development of a functional filter structure. Functional block 16 produces an output variable representing the desired performance in which are contained both the absolute accelerator pedal position (throttle valve position) and the adjustment dynamic thereof. Said output variable abuts as an input variable on the input 18 of the function block 17. The produced output variable y of the filter structure depends on the magnitude of the input variables x. The output variable "desired performance" is passed on to the basic module (functional block 11). The output 19 can be connected by two shifting positions (positions 20 and 21) with a signaling line 22 appearing below in the drawing or a signaling line 23 appearing above. In the connection drawn the input variable x is passed undelayed as output variable y via the line 23 to the output 19. The following filter equations apply:

Detailed Description Text (123):
If the filter constant k is high, a change from x(n) very quickly becomes effective on the output. If the filter constant k is on the contrary low, a change of x(n) becomes noticeable on the output only with delay. This tendency means the use of lower filter constants and therewith a small weighting of the change in great changes, while small and defined changes, on the other hand, are taken into consideration with high filter time constants, that is, with a quick penetration factor. A small, defined change can mean, for example, the slow (defined) taking back of the accelerator pedal.

Detailed Description Text (128):
FIG. 7 to 9 show one part of the fuzzy (sub) sets in the example of the change of accelerator pedal position (FIG. 7), of the accelerator pedal position (FIG. 8) and of the braking time (FIG. 9). The levels: negatively great, negatively medium, negatively medium small and negatively small serve to describe the change of accelerator pedal position. The flat quantities very small, small and medium large define the accelerator pedal position. The levels: small, medium and large apply to the braking time.

Detailed Description Text (133):
In mountain driving (case 1), the engine braking action must be utilized. When the accelerator pedal position=zero (that is, desired performance=zero), the actual speed level is first retained. If the driver actuates the brake away from said mode, a downshifting by one or more gears is initiated depending on intensity of the desired performance. Said downshifting is carried out depending on the actual engine speed (turbine speed). An excessive braking of the vehicle is prevented (additional rule 5).

CLAIMS:

1. A fuzzy logic control system, for changing a ratio of an automatic transmission, comprising:

detection means for detecting input variables derived from a driver-vehicle system, said input variables comprising at least one of a throttle valve position and an absolute accelerator pedal position, and at least one adjustment dynamic thereof;

actuator means for changing a ratio of the automatic transmission; and

fuzzy processing means for determining output variables with which the transmission ratio is determined in order to control the actuator means, the fuzzy processing means having fuzzy generation means for generating related functions in the form of fuzzy sets for said input variables, and the fuzzy processing means determining the output variables according to the input variable fuzzy sets and a set of basic and additional fuzzy generating rules;

wherein at least one of the throttle valve position and the absolute accelerator pedal position and at least one adjustment dynamic thereof are processed in a fuzzy module according to fuzzy rules based on a representative cross section of drivers, independent of an actual driving manner, to provide an output which represents a desired performance of the driver and forms a further input variable for the fuzzy processing means and thereby the set of basic and additional fuzzy generating rules.

5. The control system according to claim 2, wherein the relation between the accelerator pedal position and gradients of the accelerator pedal position and a relation between throttle valve position and adjustment of throttle valve, as a time function, is determined from a survey of a representative cross section of drivers.

17. A fuzzy logic control system, for changing the ratio of an automatic transmission, comprising:

detection means for detecting input variables derived from a driver-vehicle system;

generating means for generating related functions in a form of fuzzy sets for said input variables;

desired-performance determination means for generating a desired-performance output according to the input variables detected by the detection means, said input variables being at least one of a throttle valve position and an absolute accelerator pedal position and at least one adjustment dynamic thereof;

output determination means for determining output variables according to fuzzy generating rules and said fuzzy sets, said fuzzy generating rules containing at least a set of basic rules and additional rules, and the output determination means receiving the input variables and the desired performance output as inputs; and

means for changing a transmission ratio of the automatic transmission according to said output variables.

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L17	l7 same l4	1	L17
L16	l7 near l4	0	L16
L15	l2 near l4	0	L15
L14	l1 near l4	0	L14
L13	L12 and l8	0	L13
L12	L11 and l10	61	L12
L11	L4 same parallel	421	L11
L10	L5 same parallel	495	L10
L9	L8 and l6	8	L9
L8	L7 or l3	32163	L8
L7	throttle near (position or location)	14972	L7
L6	L5 and l4	1738	L6
L5	filter near high	13137	L5
L4	filter near low	9333	L4
L3	L2 or l1	19436	L3
L2	(gas or pedal) near (position or location)	16398	L2
L1	accelerator near (position or location)	4259	L1

END OF SEARCH HISTORY